A FOOT ELECTRODE FOR MONKEYS¹

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When electric shock is used as an aversive stimulus, the stimulating surface should be kept as uniform as possible, and the subject's impedance as constant as possible. Otherwise, variations in current density and amplitude might be introduced which would enhance the variability of the behavioral data. A uniform stimulating surface is important because the onset of electrically induced pain is associated with punctate breakdowns in skin resistance leading to the formation of "hot spots" (Muller, Loeffel, & Mead, 1953). A relatively constant impedance is important because small variations in stimulating current may lead to considerable changes in behavior, such as response rate on an avoidance schedule (Boren, Sidman, & Herrnstein, 1959).

One method typically used to deliver electric shock to monkeys kept in restraining chairs is to attach one lead from the stimulator output to the metal seat and the other lead to a metal rod on which the monkey rests its feet. Such an arrangement was not suitable for our work with titration schedules (*e.g.*, Weiss & Laties, 1959). On such schedules, the stimulus is applied continuously. The usual method of delivering shock was unsuitable for two reasons. First, it failed to give precise enough control over the stimulus. Second, with continuous shock, every withdrawal of the foot or lifting of the hips allows the monkey to escape the shock.

Figure 1 shows a front view of the electrode "shoe" devised as a solution. The monkey's feet are fastened to aluminum plates, bent at the back. Each shoe is attached to a lead from the stimulator. The shoe is 5 in. long by 2 in.

wide, and the ankle support is 2 in. high. The shoe is secured to a block of bakelite, which, in turn, is attached to the metal rod foot-rest. Consequently, the angle of the limb can be adjusted to a comfortable position. The feet are kept in the shoe by strips of "Velcro" (American Thread Company), a fabric zipper substitute. Three sets of Velcro strips 1 in. wide are usually enough to keep the sole of the foot in good contact with the shoe without undue circulatory disturbances.

Fig. 1. Front view of the shoe.

Another useful feature in this device is that it can be used as a manipulandum. If a hinge is so fastened that the shoe moves up and down when the monkey rotates its ankle, then foot tapping can be used as an operant if a microswitch whose arm is moved by movement of the shoe is attached to the bakelite base. The screw and bent strip of brass shown in the right side of Fig. 1 are used to limit the extent of movement.

Preparation of the sole of the foot before an experiment also helps to reduce variability. Before a session, we typically clean the animal's feet with alcohol or ether in order to remove dirt and loose particles of skin.

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This usually leaves a D.C. resistance of about 30,000 ohms, which can be reduced to about 10,000 ohms by applying a noncorrosive electrode paste such as EKG Sol (Burton, Parsons & Co.).

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